

REMARKS

Claims 1-10 are pending in the Application and have been rejected. No amendments have been made in this response.

1. Claim Objections

The Examiner has objected to Claims 1-2 and 5-6 and contends that the term “cross-sectional dimension” is unclear. Final Office Action at 2.

The Applicant respectfully traverses the objection. Examples of the particulate form of the invention are shown in the Application in Figures 1A and 1B. The examples shown in these figures also show that the particulates can have a range of cross-sectional dimensions.

The Applicant has used the term “cross-sectional dimension” in accordance with the usual and customary meaning of the words as defined in *The American Heritage Dictionary, Second College Edition*, Houghton Mifflin Company, Boston, 1982. In this dictionary, the word “cross-section” is defined as “[a] section formed from a plane cutting through an object, usually at right angles to an axis.” (See Exhibit A.) The word “dimension” is generally defined as “[a] measure of spatial extent, esp. width, height, or length.” (See Exhibit B.)

In light of the foregoing, Applicant respectfully requests that the Examiner withdraw the objections to Claims 1-2 and 5-6.

2. Rejections Under 35 U.S.C. § 103(a) as Being Obvious Over Smalley in View of Jin

The Examiner has rejected Claims 1-10 under 35 U.S.C. § 103(a) as obvious over Smalley et al., US Pub. 2002/0085968 (“Smalley”) in view of Jin et al., U.S. Patent 6,250,984 (“Jin”). Final Office Action at 2. Applicant respectfully traverses the rejection.

Claim 1 requires, *inter alia*, an electron emitter that comprises a “carbon nanotube particulate on a surface wherein the carbon nanotube particulate comprises entangled small-diameter carbon nanotubes arranged in a three-dimensional network . . . wherein the carbon nanotube particulate has a cross-sectional dimension in a range of about 0.1 micron and about 100 microns.”

Jin discloses a process for fabricating nanotube field emitter structures. As shown in Figures 2A-2F and described at column 5, line 40 through column 9, line 11, the process begins by mixing carbon nanotubes 10 (e.g., a “tangled spaghetti” configuration) and conductive powder 12 (e.g., metal or alloy powder). (Figure 2A, and column 5, lines 43-64.) Next, the composite of nanotubes and conductive powder is pressed into a green compact 14 and either sintered or melted to form an ingot. (Figure 2B, and column 7, lines 35-55.) Next, the ingot is sectioned parallel to the intended emitter surface. (Figure 2C, and column 8, lines 1-8.) The sectioning creates a number of broken nanotube ends at the sectioned surface.

After shaping the ingot (Figure 2D, and column 8, lines 16-19), a layer of metal is etched from the ingot 17 surface, to provide a “multitude of protruding nanotubes.” (Figure 2E, and column 8, lines 28-31.) Although the nanotube ends that protrude from the ingot are not necessarily parallel to each other, “the average deviation of the long axis of the nanotubes from a line normal to the supporting surface at the point on the surface from which the nanotube protrudes, is less than 45° . . .” (Column 8, lines 47-67.) The structure produced by this process can then be assembled into a field emitting device. (Figure 2F, and column 9, lines 3-11.)

Therefore, although the ingot prepared by *Jin* contains a spaghetti-like mass of nanotubes, they are buried under the surface of the ingot. All that protrudes from the surface of the ingot are individual nanotubes, as can be seen clearly in Figures 2E and 12. (See the

nanotube emitters 112, which are described at column 15, lines 38-42.) Thus, the nanotube structures that are *on* the surface in *Jin* (i.e., extending outward from the surface) are not particulates that each comprise a plurality of entangled nanotubes, but instead are individual nanotubes. The carbon nanotubes arranged in a three-dimensional network in *Jin* are beneath the surface of the ingot, not *on* the surface as required by claim 1. Furthermore, *Jin* makes no suggestion that there should be a particulate that comprises entangled carbon nanotubes on top of a surface. *Jin* actually teaches away from such a structure, since *Jin* emphasizes the importance of emission from individual broken nanotube tips, rather than from a tangled aggregate of nanotubes. (Column 4, lines 38-55.)

Smalley teaches a felt or a mat comprising a tangled collection of single-wall carbon nanotube ropes stuck together having sizes of 10 mm², 100 mm², 1000 mm² or greater. (See *Smalley*, paragraph 89.) Mats and felts are two out of many different nanotube structures disclosed by *Smalley*, and there is no suggestion that these structures should or could be used as electron emitters. Furthermore, the dimensions that the Examiner references in paragraph 88 of *Smalley* relate to ropes of nanotubes, as opposed to the felt in paragraph 89 which comprises a collection of multiple ropes stuck together in a mat. Therefore, even if one could consider the felt of *Smalley* to be relevant to electron emitters, which *Smalley* plainly does not suggest, the dimensional range recited in claim 1 for the nanotube particulate would still not be satisfied by the felt of *Smalley*.

An obviousness rejection based on a combination of references requires a motivation or suggestion to combine the references, coupled with a reasonable expectation of success. The motivation or suggestion must be in the prior art, in the knowledge of one of ordinary skill in the relevant art, or in some cases in the nature of the problem to be solved. *In re Huston*, 308 F.3d

1267, 64 U.S.P.Q.2d 1801, 1810 (Fed. Cir. 2002); *Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 65 U.S.P.Q.2d 1961, 1971-1972 (Fed. Cir. 2003).

Furthermore, the references must suggest the desirability, and thus the obviousness of making the combination, without the benefit of hindsight reasoning. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not in applicant's disclosure. "One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."

In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

There is no motivation or suggestion to combine the nanotube emitter structure of *Jin*, in which a tangled mass of nanotubes are buried in a metal ingot and only individual nanotube tips protrude from the surface of the ingot, with the felt or mat of *Smalley*, which has nothing to do with electron emitters.

Because a *prima facie* case of obviousness has not been established for Claim 1, this claim cannot be held obvious under 35 U.S.C. § 103(a). Likewise, Claims 2-10, which are dependent, either directly or indirectly, upon Claim 1, are also not obvious for same reasons as Claim 1.

In light of the foregoing, Applicant respectfully requests that the Examiner withdraw the rejection of Claims 1-10 under 35 U.S.C. § 103(a) as obvious over *Smalley* in view of *Jin*.

3. Conclusion

Applicant respectfully contends that claims 1-10, as presented herein, are now in condition for allowance.

The Examiner is invited to contact the undersigned attorney at (713) 934-4094 with any questions, comments or suggestions relating to the referenced patent application.

Respectfully submitted,

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